TRYPANOSOMES OBTAINED BY FEEDING WILD *GLOSSINA MORSITANS* ON MONKEYS IN THE LUANGWA VALLEY, NORTHERN RHODESIA

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(Fourth Interim Report of the Luangwa Sleeping Sickness Commission, British South Africa Company)

(Received for publication 16 *August,* 1912)

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I. INTRODUCTION

During the sojourn of the Commission at Nawalia, experiments were undertaken with the object of ascertaining the species of trypanosomes transmitted, in nature, by *Glossina morsitans*, Westw. The flies, as they were brought to the laboratory, were fed on clean monkeys, which were the only animals available for the purpose. Unfortunately, owing to the lack of healthy goats and sheep, no definite conclusions can be drawn as to whether the fly was infected with such species as *Trypanosoma vivax* and *Trypanosoma nanum*, both of which are of common occurrence in game and domestic stock. A certain amount of evidence exists, however, to show that both parasites are transmitted, in nature, by *Glossina morsitans*. Experiments are now in progress to determine this point.

II. RESULTS OF FEEDING WILD *GLOSSINA MORSITANS* ON HEALTHY MONKEYS

From day to day, freshly-caught *Glossina morsitans* were fed on healthy monkeys. In all, 3,410 flies were fed in batches, as they were brought to the laboratory, on 33 monkeys, but as five of the latter died within two or three days, inferences can only be drawn as to the infectivity of the 3,008 flies fed on the remaining 28 animals. Details of the experiments are given in Table 1.

TABLE 1.—Results of feeding freshly-caught *Glossina morsitans* on healthy monkeys

No. of Experiment	Date	No. of flies fed	Result	Trypanosome isolated
1	21.6.11	18	Negative	
4	6.7.11	100	Infection	*Tryp. ignotum*, sp. nov.
7	19.7.11	97	Negative	
22	28.7.11	160	Infection	*Tryp. ignotum*, sp. nov.
35	7.8.11	193	,,	*Tryp. ignotum*, sp. nov.
95	30.10.11	90	Negative	
96	30.10.11	82	Infection	*Tryp. rhodesiense*
121	14.11.11	98	Negative	
143	4.12.11	100	,,	
100	6.12.11	105	Infection	(?) *Tryp. rhodesiense*; animal died day after becoming infected
215	13.1.12	41	,,	*Tryp. ignotum*, sp. nov.
210	7-12.1.12	269	,,	*Tryp. rhodesiense*
217	16.1.12	200	,,	*Tryp. rhodesiense*
224	23.1.12	28	Negative	
259	13.2.12	104	,,	
316	20.3.12	101	Infection	*Tryp. rhodesiense*
317	21.3.12	112	,,	*Tryp. pecorum*
326	25.3.12	93	Negative	
329	26.3.12	130	Infection	*Tryp. ignotum*, sp. nov.
330	27.3.12	137	,,	*Tryp. ignotum*, sp. nov.
333	28.3.12	74	,,	*Tryp. rhodesiense*
334	29.3.12	67	Negative	
336	30.3.12	109	Infection	*Tryp. ignotum*, sp. nov.
340	1.4.12	108	,,	*Tryp. ignotum*, sp. nov.
342	2.4.12	52	Negative	
343	3.4.12	85	Infection	*Tryp. rhodesiense* and *Tryp. ignotum*, sp. nov.
348	4.4.12	90	Negative	
353	6.4.12	137	Infection	*Tryp. pecorum* and *Tryp. ignotum*. sp. nov.
*94	15.9.11	194	—	Goat, subinoculated monkeys and rats did not become infected

* As yet we are uncertain whether goats are susceptible to *Tryp. ignotum*, hence the flies fed on this animal have not been considered in estimating the proportion infected with this parasite.

It will be seen from the table that three species of trypanosomes were isolated, namely *Trypanosoma rhodesiense*, *Trypanosoma pecorum*, and a third, hitherto undescribed parasite, for which we propose the name *Trypanosoma ignotum*.

An analysis shows that of the 3,202 flies used, at least 19 were capable of infecting monkeys. This figure is based on the assumption that, with the exception of Experiments Nos. 343 and 353, each batch contained but a single infective fly. In each of these experiments it is highly probable that at least two infective flies were present, as in the former both *Trypanosoma rhodesiense* and *Trypanosoma ignotum*, sp. nov., were found in the monkey's blood, and in the latter both *Trypanosoma pecorum* and *Trypanosoma ignotum*, sp. nov. The proportion of flies infected with each of the three trypanosomes is given in tabular form.

TABLE 2.—Proportion of wild *Glossina morsitans* infected with *T. rhodesiense*, *T. pecorum*, and *T. ignotum*, sp. nov.

Species	No. of flies fed	No. of infections	Ratio of infected to non-infected flies
T. ignotum	3008	10	1 : 300
T. rhodesiense	3202	6*	1 : 534
T. pecorum	3202	2	1 : 1600

* In our second interim report, one experiment in which *T. rhodesiense* was obtained, was inadvertently omitted, so that this parasite was isolated in 6, instead of 5 instances. In addition, Monkey No. 100 became infected four days after the flies had been fed on it. As the animal died the same day we were unable to decide the species of trypanosome present, but from the short incubation period it is highly probable that the parasite was *T. rhodesiense*. On this assumption the ratio of infected to non-infected flies would be 1 to 455.

III. DESCRIPTION OF TRYPANOSOMES

1. *Trypanosoma rhodesiense*

2. *Trypanosoma pecorum*

In a previous report, 1912 (*a*), it was stated that *Trypanosoma pecorum* had been isolated from one group of flies only. This statement now requires to be qualified, inasmuch as in Experiment No. 353 both *Trypanosoma pecorum* and *Trypanosoma ignotum*, sp. nov., were obtained. In stained preparations of the blood of

Pathogenicity

In monkeys, the virulence of the trypanosome was found to be very great. The disease is of a fulminating character, the parasites increasing rapidly in number until the animal's death. The trypanosome is of equal virulence in those animals infected directly by the bites of the tsetse flies and in those cases where the strain was passed from monkey to monkey. The incubation period varied from three to ten days, the average being seven, and death occurred two or three days after the parasites appeared in the peripheral blood.

It is interesting to note that on reaching the plateau three monkeys failed to become infected when inoculated with the Valley strain of the parasite. At Nawalia a failure was not recorded, and it is difficult to understand those mentioned, more particularly as the parasite is of frequent occurrence in the plateau flies and monkeys infected with this strain react in the same manner as those infected by the Valley flies.

A rabbit was successfully infected with the strain by subinoculation from a monkey. The incubation period was 22 days, and the duration of the disease 66.

One guinea-pig, five rats, and four mice were found to be refractory. Moreover, negative results were obtained by feeding infective flies on rats.

TABLE 4.—Pathogenicity of *Trypanosoma ignotum*, sp. nov.

Animal	Number used	Incubation period days	Duration days
Monkey	20	3–10, average 7	5–14, average 10
Rabbit	1	22	66
Guinea-pig	1	Negative	
Rat	5	,,	
Mouse	4	,,	

Diagnosis

Morphologically the parasite appears to be distinct from any hitherto described species. The graph showing the distribution of the trypanosomes in respect of length resembles very closely that of *Trypanosoma uniforme*, but the parasites are at once distinguished by the fact that whereas *Trypanosoma uniforme* is invariably furnished with a free flagellum this, as mentioned above, is of rare occurrence in *Trypanosoma ignotum*, sp. nov. Moreover, the difference between the two trypanosomes is clearly demonstrated by the reaction of subinoculated animals. According to the Royal Society's Commission (1911), *Trypanosoma uniforme* is innocuous to monkeys, an observation which has been confirmed by Fraser and Duke (1912), who record that they were unable to infect these animals by subinoculation from game harbouring the parasite, although goats were readily infected. Whether or not the trypanosome with which we are dealing will infect cattle and goats we are, at present, not in a position to state, but the fact that a large number of monkeys, and one rabbit, quickly succumbed to the disease indicates clearly that the two parasites are not identical.

No information is at present available regarding the original host of the trypanosome. Although the parasite has been isolated from wild *Glossina morsitans* much more frequently than any other trypanosome, it has never been found in game or domestic stock. Nothing resembling it has been seen in the peripheral blood of any animal examined in the Luangwa Valley and on the Congo-Zambesi watershed. These include 174 wild animals (elephant, rhinoceros, hippopotamus, buffalo, eland, zebra, wildebeest, roan, kudu, hartebeest, true waterbuck, Crawshay's waterbuck, puku, mpala, bushbuck, duiker, klipspringer, bushpig, warthog, lion, hunting dog, caracal, galago, squirrel, genet, giant rat and rabbit), 35 domestic animals (cattle, goats, and dogs), 203 monkeys, 128 wild rats, and 15 wild mice—making a total of 555. Fifty-seven monkeys have been subinoculated from game and domestic animals, and in no instance has an infection with this trypanosome been observed.

In view of the fact that we have been unable to find the vertebrate host, we propose to name the parasite *Trypanosoma ignotum*.

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Transmission

In one experiment the infective fly was determined to be one of a group of ten. These were then killed and dissected. Nine of the flies were found to show no trypanosomes in the gut, proboscis, salivary glands, or sucking stomach, whereas in the tenth a heavy infection of the proboscis was encountered. The gut, salivary glands, and sucking stomach were negative. This observation would indicate that the development of the trypanosome occurs in the proboscis.

IV. TRANSMISSION OF *TRYPANOSOMA VIVAX* AND *TRYPANOSOMA NANUM*

We are unable, at present, to make any definite statement on this subject, but might record that the goats on which the flies used for breeding purposes were fed became infected with both these trypanosomes. Unfortunately, we cannot exclude, with certainty, the possibility of the goats having been bitten by flies other than *Glossina*. More exact experiments to determine the point are now in progress.

V. CONCLUSIONS

The following trypanosomes, *T. rhodesiense*, *T. pecorum*, *T. ignotum*, sp. nov., and probably also *T. vivax* and *T. nanum*, are transmitted, in nature, by *Glossina morsitans* in the Luangwa Valley.

NGOA, N. RHODESIA,
June 20, 1912.

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